NMFS AFSC Increasing Bottom Trawl Survey Coverage on Eastern Bering Sea Upper Continental Slope

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History Of AFSC Surveys On Eastern Bering Sea Continental Slope

During 1979 through 1991, the Alaska Fisheries Science Center (AFSC) of the National Marine Fisheries Service, often in cooperation with the Japan Fisheries Agency, conducted bottom trawl surveys of the groundfish resources of the eastern Bering Sea upper continental slope (EBS-UCS). These surveys were conducted triennially from 1979 through 1991, with an additional survey done in 1981. American vessels participated in the 1979, 1988, and 1991 surveys and Japanese vessels participated in 1979, 1981, 1982, 1985, and 1988.

The trawls used for these surveys were chosen to accommodate the extremely rugged terrain of the UCS. For example, trawls used by the Japanese vessels were rigged with very large rollers (44-55 cm diameter), allowing an opening of 25-30 cm between the bottom of the net and the seafloor. This allowed most of the invertebrates and many fish to avoid capture and limits the usefulness of these surveys to comparing relative densities of major, large-bodied fish species. Catch data from these historical surveys indicate that identification of organisms caught was not done with a lot of attention to distinguishing some of the less important taxa. Catch data from surveys done between 1979 and 1991 averaged only 18 different taxa per haul (fewer than 14 species of fish and 5 species of invertebrates). Without information on the density of invertebrates and smaller, less commercially important fishes, we lack the ability to fully understand the community structure and ecology of this habitat.

Large roller gear similar to that used by Japanese survey vessels.

Year	Vessel	Nation	Number of Hauls Made on Continental Slope
1979	Discovery Bay	USA	60
1979	Shotoku maru	Japan	23
1979	Yakushi maru	Japan	82
1981	Ryoan maru	Japan	224
1982	Ryujin maru	Japan	353
1985	Daikichi maru	Japan	341
1988	Miller Freeman	USA	103
1988	Tomi maru	Japan	33
1991	Miller Freeman	USA	93
2000	Morning Star	USA	117

Plans For The New Ebs - Ucs Survey Series

Financial and vessel resources became available in 2000 to resume the effort of surveying the biota of the UCS of the eastern Bering Sea. AFSC scientists evaluated the results of past surveys and concluded we could substantially improve the quality of information if we made some changes. The most fundamental change was to conduct the survey so that it would yield a better picture of the whole ecosystem, gathering information on fish, invertebrates, and the environment. This requires using standardized trawls that sample the biota more completely. It also requires the ability to identify fish and invertebrates reliably. Another important change was committing to funding a biennial survey that would adhere to the same strictly standardized trawling and catch-sampling protocols each time it is repeated.

Previous bottom trawl surveys on the UCS of the eastern Bering Sea had less rigorous standards in terms of trawling and sampling protocol. We also lacked the technology to monitor and evaluate acceptable gear performance in this extreme environment that we have now. We have made substantial improvements in our survey technology and methodology over the past decade and are now able to apply these enhancements to this bottom trawl survey.

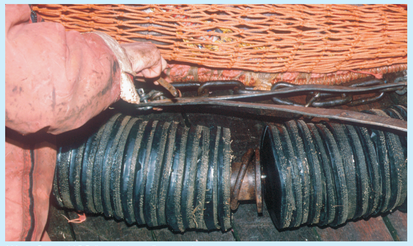
Why Do We Think We Can Do A Better Job Now?

AFSC scientists have successfully developed and used trawl gear and methods for comprehensively sampling the UCS habitat off Washington, Oregon, and California (Lauth et al 1998; Lauth 1999, 2000, 2001). Their work during the 1990s has resulted in a vast improvement in the quality of information for managed groundfish species, as well as a fuller understanding of community structure. The trawl used for this work is rigged with "mudsweep" ground gear, a solid string of 20-cm diameter rubber disks strung on 16 mm chain, allowing for virtually full contact with the seafloor along the entire length of the footrope. We've learned, by using this trawl, that the rugged appearance of the UCS terrain is due more to its steepness than its hardness (or "rockiness"). The substrate in these habitats consists mostly of mud.

We tow this trawl at a slower speed (2.3-2.5 knots vs 3.0 knots) to enable us to sample deeper on the slope with the lengths of trawl wire that we have available. We also use heavier trawl doors than those used on standard AFSC bottom trawl surveys and they are rigged with 4-point bridles to improve their stability at this slower towing speed.

We've also improved our ability to identify organisms reliably. Our staff now includes taxonomists who have instituted an annual training program to help field samplers identify fish and invertebrates in our catches. We have increased our usage of digital cameras and shipboard photographic data bases to facilitate this skill.

UCS trawl doors rigged with stabilizing 4-point bridles.



West Coast UCS "mudsweep" ground gear.

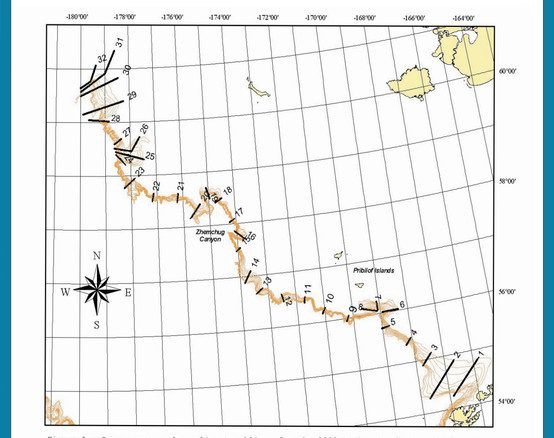


Figure 1.--Survey area and sampling tracklines for the 2000 Bering Sea bottom trawl survey of continental slope groundfish and shellfish resources. Depth contours (100 m) from 200 to 1,100 m are shown.

Work Done In 2000 - The "Pilot Survey"

Although we thought we could apply the West Coast slope survey gear and methodology to the eastern Bering Sea slope survey, by all reports the Bering Sea slope appeared much more rocky, steep, and rugged. We concluded that it would be prudent to set our objectives in 2000 to

1. familiarize ourselves with the intended survey area and identify especially challenging sections and
2. conduct a gear-comparison study between two configurations of a standard AFSC sampling trawl:

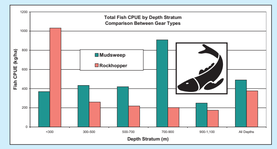
   a. the standard West Coast "mudsweep" Poly Nor'Eastern trawl and
   b. the same trawl net rigged with larger "rockhopper" ground gear, which helps prevent net damage by lifting the leading edge of the net over rocks and other obstacles.

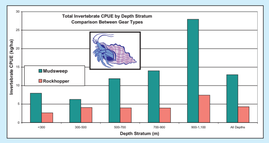
We fished with both trawls at each of approximately 60 stations at depths between about 200 and 1,100 m and compare how well each net performed. This was judged by

1. observing how often and how badly each configuration of the trawl was damaged,
2. comparing relative catch rates of fish and invertebrates caught with each configuration, and
3. comparing general gear performance (continuity of bottom contact, settling time, etc.).

Experimental "rockhopper" ground gear.

What We Learned In 2000





The study in 2000 was conducted during a 35-day charter aboard the trawler *Morning Star*. We were able to successfully tow with both trawls at nearly every station attempted, resulting in 56 pairs of hauls to compare relative catch rates. We were unable to fish with either net at only two of the stations in the deepest stratum, where the steepest terrain is found. The "mudsweep" trawl was torn or damaged on only three hauls, two of which were at the same station, while the "rockhopper" gear never sustained any damage. Most importantly, however, we found that wherever we were able to sample successfully with one gear, we were able to sample with both. This substantiated what we'd found on the West Coast slope surveys, that the terrain is steep, but not as rocky as it appears. It is difficult, but not impossible, to obtain high quality bottom trawl samples at most stations.

A comparison of catch rates of the two trawl configurations used in 2000 revealed, as expected, that the "mudsweep" gear caught substantially more invertebrates in all depth strata and more fish in all strata except the shallowest. More species of invertebrates and fish were caught with the "mudsweep" gear, as well. Shallow stratum catch rates of fish were strongly influenced by large catches of Pacific ocean perch, the largest of which (over 16 tons) was made with the "rockhopper" gear.

In terms of general performance, the "mudsweep" gear appeared to tend bottom more closely than the "rockhopper" gear. After bouncing over irregular bottom features, the "rockhopper" trawl tended to take longer to settle back to the bottom. The larger cross-section of this ground gear is probably responsible for this effect, since it causes more drag when passing through the water.

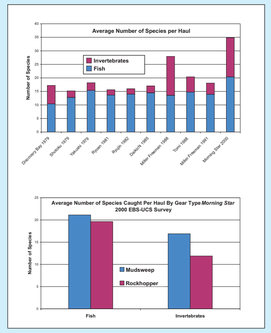
Although better navigation and bathymetric information is available now, this is still a challenge to effectively surveying this steep habitat. A great deal of time is required to find trawlable areas and precision trawling at very specific sampling sites is quite demanding. Past surveys relied on Loran positioning, which is far less accurate and repeatable than the GPS technology available today. However, there has been no improvement in the basic bathymetric information in this area and much of it dates back to the early 20th century.

We also learned that there are a LOT of LARGE giant grenadiers out there! Six catches contained over 2 tons of this species alone, the largest catch being nearly 30 tons. Catches contained an average of 35 different taxa, including over 20 species of fish and 15 species of invertebrates, versus only 18 different taxa per haul (13.75 species of fish and 4.4 species of invertebrates) in historical surveys catches. Several of the organisms caught in 2000 (sculpins, snailfish, eelpouts, etc) are believed to be undescribed species and AFSC scientists are collaborating with taxonomists at other institutions to classify as many of these as possible. We even recovered some fossils in one catch and are working with an ichthyoarchaeologist to identify them.

Plans For 2002 & Beyond

This summer (2002) we will return to the UCS of the eastern Bering Sea for a 57-day charter aboard the *Morning Star*. Based upon the work done in 2000, we have chosen to conduct the survey with the "mudsweep" trawl. Our goal this summer will be to locate trawlable station sites for approximately 90 more stations and obtain trawl samples at those sites. If time remains, we will return to the stations fished in 2000 and sample as many of those stations as possible.

The survey will then be repeated every two years and become part of the time series of AFSC bottom trawl surveys in the Gulf of Alaska, Aleutian Islands, and eastern Bering Sea. Stock assessment teams use the results of all of these surveys, along with echo integration-trawl surveys conducted by the AFSC and catch-per-effort information from the fishing industry, to provide management advice to the North Pacific Fishery Management Council. Fisheries on the UCS of the eastern Bering Sea primarily target on Greenland turbot and sablefish, with a bycatch of arrowtooth flounder and several species of rockfishes, including Pacific ocean perch, shortraker, rougheye, and shortspine thornyheads. Some crabs and shrimps are also harvested from this habitat.



Acknowledgements

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